

Robert K. Rowe et al.
Application No.: 09/832,534
Page 2

PATENT

Please cancel Claim 48 and amend Claims 1 – 3, 10, 12, 19 – 21, 33, 46,
and 47 so that the pending claims read as follows:

1 1. (Amended) A system for verifying the purported identity of a
2 targeted individual comprising:
3 an enrollment database including tissue optical spectral data collected
4 from at least one enrolled persons, said enrolled persons tissue optical spectra data having
5 a plurality of measurement values;
6 means for obtaining at least one tissue optical spectral data and purported
7 identity from said target individual, said target individual's tissue optical spectral data
8 having a plurality of measurement values;
9 means for comparing optical spectral distributions of said target individual
10 tissue optical spectral data and said enrolled persons tissue optical spectral data, said
11 enrolled person tissue optical spectral data corresponding to the purported identity of the
12 target individual, said comparison providing a measure of the degree of similarity
13 between said target individual tissue optical spectral data and said enrolled person's
14 tissue optical spectral data, said comparison including:
15 computation of a discriminant spectrum over a plurality of
16 wavelengths, wherein the discriminant spectrum at each wavelength is derived from said
17 target individual tissue optical spectral data and said enrolled persons tissue optical
18 spectral data at that wavelength; and
19 a determination whether the discriminant spectrum meets a
20 calibration criterion; and
21 means for positively verifying said target individual's identity by
22 confirming that said target individual's measure of spectral similarity is at least as similar
23 as an established threshold value.

1 2. (Amended) The system as recited in claim 1, wherein said means
2 for obtaining said target individual tissue optical spectral data includes means for
3 measuring optical radiation reflected from sub-epidermal tissue of said target individual.

Robert K. Rowe et al.
Application No.: 09/832,534
Page 3

PATENT

1 3. (Amended) The system as recited in claim 1, wherein said means
2 for obtaining said target individual tissue optical spectral data includes a spectrometer.

1 4. (As Filed) The system as recited in claim 3, wherein said
2 spectrometer is an FTIR spectrometer.

1 5. (As Filed) The system as recited in claim 3, wherein said
2 spectrometer is a grating array spectrometer.

1 6. (As Filed) The system as recited in claim 1, wherein said optical
2 spectral data include near-infrared wavelengths.

1 7. (As Filed) The system as recited in claim 1, wherein said optical
2 spectral data include visible wavelengths.

1 8. (As Filed) The system as recited in claim 1, wherein said optical
2 spectral data include near-ultraviolet wavelengths.

1 9. (As Filed) The system as recited in claim 1, wherein said
2 comparison and similarity determination utilizes a classification algorithm.

1 10. (Twice Amended) A system for identifying a target individual
2 comprising:
3 an enrollment database including tissue optical spectral data collected
4 from one or more enrolled persons, said enrolled persons tissue optical spectral data
5 having a plurality of measurement values;
6 means for obtaining at least one tissue optical spectral data from said
7 target individual, wherein said means for obtaining said target individual tissue optical
8 spectral data includes means for measuring optical radiation reflected from sub-epidermal
9 tissue of said target individual, said target individual's tissue optical spectral data having
10 a plurality of measurement values;

Robert K. Rowe et al.
Application No.: 09/832,534
Page 4

PATENT

11 means for comparing optical spectral distributions said target individual
12 tissue optical spectral data and said all enrolled persons tissue optical spectral data, said
13 comparison providing a measure of the degree of similarity between said target
14 individual's tissue optical spectral data and said enrolled persons tissue optical spectral
15 data, said comparison including:
16 computation of a discriminant spectrum over a plurality of
17 wavelengths, wherein the discriminant spectrum at each wavelength is derived from said
18 target individual's tissue optical spectral data and said enrolled persons tissue optical
19 spectral data at that wavelength; and
20 a determination whether the discriminant spectrum meets a
21 calibration criterion; and
22 means for indicating identity as at least one of the said enrolled persons if
23 the calibration criterion is met.

1 11. (Previously Canceled).

1 12. (Amended) The system as recited in claim 10, wherein said means
2 for obtaining said target individual's tissue optical spectral data includes a spectrometer.

1 13. (As Filed) The system as recited in claim 12, wherein said
2 spectrometer is an FTIR spectrometer.

1 14. (As Filed) The system as recited in claim 12, wherein said
2 spectrometer is a grating array spectrometer.

1 15. (As Filed) The system as recited in claim 10, wherein said optical
2 spectral data include near-infrared wavelengths.

1 16. (As Filed) The system as recited in claim 10, wherein said optical
2 spectral data include visible wavelengths.

Robert K. Rowe et al.
Application No.: 09/832,534
Page 5

PATENT

1 17. (As Filed) The system as recited in claim 10, wherein said optical
2 spectral data include near-ultraviolet wavelengths.

1 18. (As Filed) The system as recited in claim 10, wherein said
2 comparison and similarity determination utilizes a classification algorithm.

1 19. (Amended) A system for verifying the purported identity of a
2 target individual comprising:
3 a computer including an input device and an output device;
4 an enrollment database including tissue optical spectra for at least one
5 enrolled persons;
6 means for obtaining at least one tissue optical spectrum from said target
7 individual, including an optical radiation source, an optical sampler for projecting optical
8 radiation into the tissue and for collecting radiation that substantially passed through sub-
9 epidermal tissue, an optical spectrometer for measuring the sub-epidermal optical
10 intensity over a plurality of wavelengths;
11 means for obtaining said target individual's purported identity; and
12 a program running in said computer for comparing optical spectral
13 distributions of said target individual tissue optical spectrum and said enrolled persons
14 tissue optical spectra corresponding to said target individual's purported identity, said
15 comparing including:
16 computing a discriminant spectrum over a plurality of
17 wavelengths, wherein the discriminant spectrum at each wavelength is derived from said
18 target individual tissue optical spectrum and said enrolled persons tissue optical spectra at
19 that wavelength; and
20 determining whether the discriminant spectrum meets a calibration
21 criterion.

Robert K. Rowe et al.
Application No.: 09/832,534
Page 6

PATENT

- 1 20. (Amended) A system for identifying a target individual
2 comprising:
3 a computer including an input device and an output device;
4 an enrollment database including tissue optical spectra for at least one
5 enrolled persons;
6 means for obtaining at least one tissue optical spectrum from said target
7 individual, including an optical radiation source, an optical sampler for projecting optical
8 radiation into the tissue and for collecting radiation that substantially passed through sub-
9 epidermal tissue, an optical spectrometer for measuring the sub-epidermal optical
10 intensity over a plurality of wavelengths; and
11 a program running in said computer for comparing optical spectral
12 distributions of said target individual tissue optical spectrum and all said enrolled persons
13 tissue optical spectra by computing a discriminant spectrum over a plurality of
14 wavelengths, wherein the discriminant spectrum at each wavelength is derived from said
15 target individual tissue optical spectrum and said enrolled persons tissue optical spectra at
16 that wavelength, and determining whether the discriminant spectrum meets a calibration
17 criterion.
- 1 21. (Amended) A method for verifying the purported identity of a
2 target individual utilizing an enrollment database including tissue optical spectra
3 collected from a number of enrolled individuals having known identities, said tissue
4 optical spectra having a plurality of measurement wavelengths, comprising the steps of:
5 obtaining optical target tissue spectral data from said target individual,
6 said optical target tissue spectral data having a number of measurement wavelengths;
7 obtaining said purported identity from said target individual;
8 comparing optical spectral distributions of said optical target tissue
9 spectral data and said enrolled person's tissue optical spectra, said enrolled person's
10 tissue optical spectra corresponding to the purported identity of the target individual, said
11 comparison providing a measure of the degree of similarity between said optical target

Robert K. Rowe et al.
Application No.: 09/832,534
Page 7

PATENT

12 tissue spectral data and said enrolled person's tissue optical spectra by computing a
13 discriminant spectrum over a plurality of wavelengths, wherein the discriminant spectrum
14 at each wavelength is derived from said optical target tissue spectral data and said
15 enrolled person's tissue optical spectra; and
16 positively verifying said target individual's identity by determining
17 whether the discriminant spectrum meets a calibration criterion.

1 22. (As Filed) The method for verifying the identity of a target
2 individual as recited in claim 21, wherein the method further includes a classification
3 algorithm to perform said comparison between said target individual's optical spectral
4 data and said enrolled person's optical spectral data.

1 23. (As Filed) The method for verifying the identity of a target
2 individual as recited in claim 22, wherein the method further includes classification
3 features that are determined from a set of calibration optical spectral data collected on at
4 least one individual measured more than one time.

1 24. (As Filed) The method for verifying the identity of a target
2 individual as recited in claim 23, wherein said classification features are applied to the
3 said comparison between the target optical spectral data and the enrollment spectral data
4 to determine the similarity with respect to the said classification features.

1 25. (As Filed) The method for verifying the identity of a target
2 individual as recited in claim 24, wherein said verification occurs when said comparison
3 of said target optical spectral data and said enrollment spectral data using said
4 classification features is at least as good a predetermined measure of similarity.

1 26. (As Filed) The method for identifying a target individual as
2 recited in claim 21, further comprising an enrollment database with optical spectral data
3 collected from a number of enrolled individuals, wherein said number is greater than one.

Robert K. Rowe et al.
Application No.: 09/832,534
Page 8

PATENT

1 27. (As Filed) The method for identifying a target individual as
2 recited in claim 21, further comprising an enrollment database with optical spectral data
3 collected from a number of enrolled individuals, wherein said number is equal to one.

1 28. (As Filed) The method for identifying a target individual as
2 recited in claim 21, wherein said target spectrum is added to said enrollment optical
3 spectral data after said verification of identity.

1 29. (As Filed) The method for identifying a target individual as
2 recited in claim 21, wherein said tissue optical spectra include near-ultraviolet
3 wavelengths.

1 30. (As Filed) The method for identifying a target individual as
2 recited in claim 21, wherein said tissue optical spectra include visible wavelengths.

1 31. (As Filed) The method for identifying a target individual as
2 recited in claim 21, wherein said tissue optical spectra include near-infrared wavelengths.

1 32. (As Filed) The method for identifying a target individual as
2 recited in claim 21, wherein said tissue spectra includes a substantial spectra contribution
3 from sub-epidermal tissue.

1 33. (Twice Amended) A method for identifying a target individual
2 utilizing an enrollment database including tissue optical spectra collected from a number
3 of enrolled persons, said tissue optical spectra having a plurality of measurement
4 wavelengths, comprising the steps of:

5 obtaining optical target tissue spectral data from said target individual,
6 said optical target tissue spectral data having a number of measurement wavelengths and
7 including a substantial spectral contribution from sub-epidermal tissue;

8 comparing optical spectral distributions of said optical target tissue
9 spectral data and said enrolled person's tissue optical spectra, said comparison providing

Robert K. Rowe et al.
Application No.: 09/832,534
Page 9

PATENT

10 a measure of the degree of similarity between said optical target tissue spectral data and
11 each of said enrolled person's tissue optical spectra by computing discriminant spectra
12 over a plurality of wavelengths, wherein the discriminant spectra at each wavelength are
13 derived from said optical target tissue spectral data and said each of said enrolled
14 person's tissue optical spectra; and
15 positively establishing said target individual's identity by confirming that
16 at least one of the discriminant spectra meets a calibration criterion.

1 34. (As Filed) The method for identifying a target individual as
2 recited in claim 33, wherein the method further includes a classification algorithm to
3 perform said comparison between said target individual's optical spectral data and said
4 enrolled persons optical spectral data.

1 35. (As Filed) The method for identifying a target individual as
2 recited in claim 34, wherein the method further includes classification features that are
3 determined from a set of calibration optical spectral data collected on at least one
4 individual measured more than one time.

1 36. (As Filed) The method for identifying a target individual as
2 recited in claim 35, wherein said classification features are applied to the said comparison
3 between the target optical spectral data and the enrollment spectral data to determine the
4 similarity with respect to the said classification features.

1 37. (As Filed) The method for identifying a target individual as
2 recited in claim 36, wherein said identification occurs when said comparison of said
3 target optical spectral data and said enrollment spectral data using said classification
4 features is at least as similar as a predetermined measure of similarity for a number of
5 enrolled persons optical spectral data.

1 38. (As Filed) The method for identifying a target individual as
2 recited in claim 37, wherein the target identify is chosen as the most similar of all said

Robert K. Rowe et al.
Application No.: 09/832,534
Page 10

PATENT

3 enrolled persons whose enrollment spectral data are at least as similar to the said target
4 spectral data as a predetermined measure of similarity.

1 39. (As Filed) The method for identifying a target individual as
2 recited in claim 33, further comprising an enrollment database with optical spectral data
3 collected from a number of enrolled individuals, wherein said number is greater than one.

1 40. (As Filed) The method for identifying a target individual as
2 recited in claim 33, further comprising an enrollment database with optical spectral data
3 collected from a number of enrolled individuals, wherein said number is equal to one.

1 41. (As Filed) The method for identifying a target individual as
2 recited in claim 33, wherein said target spectrum is added to said enrollment optical
3 spectral data after said identification.

1 42. (As Filed) The method for identifying a target individual as
2 recited in claim 33, wherein said tissue optical spectra include near-ultraviolet
3 wavelengths.

1 43. (As Filed) The method for identifying a target individual as
2 recited in claim 33, wherein said tissue optical spectra include visible wavelengths.

1 44. (As Filed) The method for identifying a target individual as
2 recited in claim 33, wherein said tissue optical spectra include near-infrared wavelengths.

1 45. (Previously Canceled).

1 46. (Amended) A method for verifying the identity of a target
2 individual comprising the steps of:
3 obtaining a number of enrollment optical tissue spectra from a number of
4 individuals, said enrollment optical tissue spectra having a plurality of measurement

Robert K. Rowe et al.
Application No.: 09/832,534
Page 11

PATENT

5 wavelengths, said enrolled optical tissue spectra corresponding to said enrolled
6 individual's identities;
7 obtaining an optical target tissue spectrum from said target individual, said
8 optical target tissue spectrum having a number of measurement wavelengths;
9 obtaining an identifier from said target individual;
10 selecting said enrolled optical tissue spectra that corresponds to said target
11 individual's identifier;
12 performing discriminant analysis on said optical target tissue spectrum and
13 said selected enrolled optical tissue spectrum corresponding to said identifier by
14 computing a discriminant spectrum over a plurality of wavelengths, wherein the
15 discriminant spectrum at each wavelength is derived from said optical target tissue
16 spectrum and said selected enrolled optical tissue spectrum; and
17 positively verifying said target identity if, and only if, said discriminant
18 analysis is satisfied.

1 47. (Twice Amended) A method for identifying a target individual
2 comprising the steps of:
3 obtaining a number of enrollment optical tissue spectra from a number of
4 individuals, said enrollment optical tissue spectra having a plurality of measurement
5 wavelengths;
6 obtaining an optical target tissue spectrum from said target individual, said
7 optical target tissue spectrum having a number of measurement wavelengths, wherein
8 said optical tissue spectra include a substantial spectral contribution from sub-epidermal
9 tissue;
10 performing discriminant analysis on said optical target tissue spectrum and
11 all of said enrollment optical tissue spectra by computing discriminant spectra over a
12 plurality of wavelengths, wherein the discriminant spectra at each wavelength are derived
13 from said optical target tissue spectrum and one of said selected enrollment optical tissue
14 spectra; and